(Read by title only)

13

The Invertebrate Fauna of Westernport Bay

By Brian Smith,* Noel Coleman† and Jeanette E. Watson*

Abstract: Westernport Bay is a land-locked tidal embayment of about 1,500 km² in which are two large islands: French Island centrally situated, and Phillip Island to the south facing Bass Strait. Morphologically the area is complex and may be divided into a number of habitat types each of which has its own characteristic fauna.

Seven main faunal assemblages are recognized as occurring within the Bay. These range from the faunal assemblages of the salt marsh and mangrove, and the molluscan-crustacean-polychaete associations of the littoral zone, to the sublittoral associations of the deep-water channels and reefs.

INTRODUCTION

This paper sets out briefly the present knowledge of the invertebrate fauna of Westernport Bay and shows how the distribution of this fauna is related to both the biological and the physical aspects of the environment. Although primarily concerned with the fauna, mention is also made of the dominant plant species, for these are important in many communities, feeding and sheltering large numbers of invertebrates and providing a surface for the attachment of epiphytes.

The first collections of invertebrates from Victoria were made in the 1820's, in Westernport, by scientists from the French exploration vessel *Astrolabe*. During the second half of the last century and the first half of this, several workers included Westernport fauna in studies of the invertebrates of Victoria, or made collections solely within the Bay. These include Joshua (1859, 1868) on echinoderms; MacGillivray (1859, 1868) on bryozoa; Carter (1886) on sponges; Pritchard and Gatliff (1898, 1900), Gabriel (1908) and Gatliff and Gabriel (1910, 1917, 1931) on molluscs; Parr (1932) on foraminifera; and Blackburn (1937) on hydroids.

Four more recent studies of Westernport invertebrates have been ecologically as well as taxonomically orientated. In 1965 the Fisheries and Wildlife Division, Victoria, carried out an extensive survey of the benthos around Crib Point in North Arm and in 1973–74 undertook a more extensive survey, sampling throughout the Bay. Two other studies have been carried out by groups working in conjunction with the National Museum of Victoria. The Marine Study Group of Victoria has made extensive collections of littoral animals from the Bay (Smith 1971) and the Underwater Research Group of Victoria has studied the sublittoral flora and fauna of the north-western region of North Arm (Watson 1971). The present paper is based on the results of these four surveys.

FAUNAL ASSEMBLAGES

The distribution of species within the Bay is governed by the prevailing hydrological conditions, the substratum available for settling and colonization, and the degree of aerial exposure (if any) to which the substratum is exposed at low tide. In relation to differences in these factors, seven main faunal regions, each having its own characteristic fauna, may be recognized. None of these regions is entirely homogeneous and each may be subdivided according to minor differences in the physical conditions and types of habitat it offers. The distribution of these regions within the Bay is illustrated in Fig. 1; the regions are as follow:

1. *Salt marsh*—the zone between the mangroves and the beginning of truly terrestrial vegetation: subject to intermittent inundation by very high tides.
2. *Mangroves*—the mid-tide zone occupied by mangrove trees.
3. *Tidal flats*—areas of muddy sand, usually with sea-grass beds, exposed at low tide.
4. *Beaches*—intertidal areas of clean sand.
5. *Rock platforms*—intertidal rocky areas.

* Invertebrate Department, National Museum of Victoria, Melbourne 3000.
† Marine Pollution Studies Group, Fisheries and Wildlife Division, Ministry for Conservation, Melbourne, 3000.

6. *Channel system*—the main channels of North Arm and East Arm and the subsidiary channels which feed them.

7. *Sublittoral reefs*—sublittoral rocky areas.

1. Salt Marsh

Because it occurs above the normal high tide level, receiving seawater only by seepage or during high spring tides, this habitat is classed as a littoral fringe zone. It is a well defined area, extending along most of the shoreline of North Arm, between the upper limit of the mangroves and the beginning of the typical terrestrial vegetation. The salt content of the plants and soil of this zone is relatively high, and the soil is bound by the plants' root systems.

The dominant plants of this zone are *Arthrocnemum arbusculum* (R. Br.) Moq., *Suaeda australis* (R. Br.) Moq., *Puccinellia stricta* (Hook.f.) C. Blom, and *Salicornia quinqueflora* Bunge ex Ungern-Sternberg. The fauna is characterized by a number of species of air-breathing snails including *Salinator solida* (von Martens), *Ophicardelus ornatus* (Ferussac), *Marinula meridionalis* (Brazier) and *Truncatella scalarina* Cox. The littorinid *Bembicium melanostomum* (Gmelin) is found in the lower part of the salt marsh zone where it borders on the mangroves.

2. Mangroves

Bird (1971) describes the mangrove community in detail and discusses its possible influence in the overall ecology of Westernport. The mangrove trees grow in, and help to consolidate, a soft muddy substratum; their trunks and pneumatophores are the only firm substratum in this zone and a number of epiphytic filamentous algae, including *Caloglossa, Catanella* and *Bostrychnia,* grow on them. *Bembicium nanum* (Lamarck), *B. melanostomum,* and the barnacle *Chamaesipho columna* (Spengler) are commonly found on the trunks and pneumatophores, and the mussel *Mytilus edulis planulatus* (Lamarck) may be found attached to the roots.

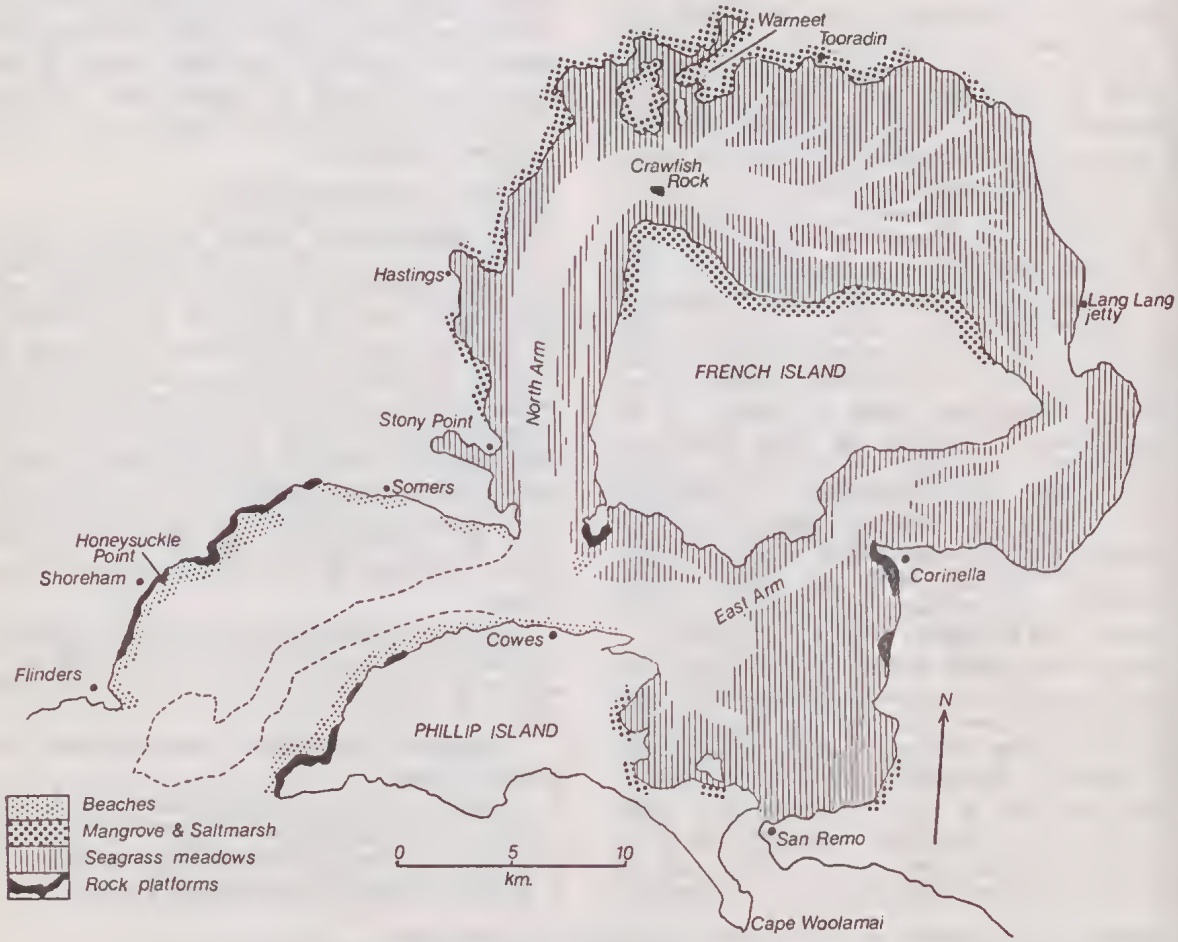

Fig. 1—Map of Westernport Bay showing main faunal regions.

3. Tidal Flats

The tidal flats, situated mainly in the north and east of the Bay, consist largely of fine, muddy sand overlying, in many places, old shell beds. They support meadows of the sea-grass *Zostera muelleri*, Irmisch ex Aschers, the root systems of which help to consolidate the soft substratum. At low tide parts of the flats are exposed to the air, but large areas remain covered with a few inches of water.

Infaunal species include the bivalves *Anadara trapezia* (Deshayes), *Homalina deltoidalis* (Lamarck), *H. mariae* (Tenison Woods), *Laternula tasmanica* Reeve and the mud yabby, *Callianassa*. Also found on or in the substratum are the arenaceous foraminiferan species *Ammotium cassis* (Parker), and *Trochammina sorosa* Parr, polychaetes belonging to the genera *Nepthys*, *Lumbrineris* and *Nereis*, the air-breathing snail *Salinator fragilis* (Lamarck) and the carnivorous gastropods *Nassarius burchardi* Phillipi and *Polinices sordidus* (Swainson). The sea-grass bears epiphytic filamentous algae, occasional sponges and ascidians, and a large number of grazing molluscs of the families Trochidae and Rissoidae.

4. Beaches

Open beaches composed largely of clean sand are found at a number of localities in the south of the Bay and support a scant fauna consisting of only a few species including the beach bloodworm *Abarenicola*. In shallow water where wave action is moderate, the offshore sands are colonized by a fringe of the marine angiosperm *Amphibolis antarctica* (Labill.) Saunder & Ascherson, whose wiry stems and flat leaves support many species of encrusting coralline algae and bryozoa, the hydroid *Lineolaria spinulosa* Hincks, and the colonial ascidian *Molqula sabulosa* (Quoy & Gaimard). High tide mark is usually lined with detritus of *A. antarctica* which remains damp during low tide and so provides a sheltered environment for large numbers of the sand hopper *Orchestia* sp., enchitrid worms, and the shore crab *Carcinus maenas* (Linné).

5. Rock Platforms

The intertidal substratum in much of the southwestern region of the Bay consists of wave-cut basalt rock platforms with tide-pools, gutters, and loose rocks on the seaward edge. One or two other areas of intertidal rock, either of weathered basalt or of ferruginous sand stone, are found in the northern and eastern areas of the Bay, and isolated rocks are found on the intertidal flats.

The upper littoral zone, especially on the more sheltered platforms, has colonies of the blue-green algae *Rivularia* and *Nostoc*, and of the black lichen *Lichina confinis*, C. Argardh. The gastropods *Melarapha unifasciata* (Gray), *M. praetermissa* May, and, at slightly lower levels, *Siphonaria diemenensis* Quoy & Gaimard occur on the rock surface.

In the mid-littoral zone, the gastropods *Cellana tramoserica* (Sowerby), *Bembicium nanum*, *Melanerita melanotragus* (Smith) and *Austrocochlea* spp. are found on the upper rock surfaces whilst beneath boulders and stones the limpet *Chiazacmea flammea* (Quoy & Gaimard), the blue sea-star *Patiriella exigua* (Lamarck) and the crab *Paragrapsus quadridentatus* Milne Edwards are common. On more exposed faces the barnacles *Ibla quadrivalvus* (Cuvier) and *Chamaesipho columna*, the mussels *Mytilus edulis planulatus* and *Modiolus pulex* (Lamarck), and the tubeworm *Galeolaria caespitosa* Lamarck occur.

The lower littoral zone and the sublittoral fringe possess a very rich and diverse fauna and throughout this zone the undersurfaces of the rocks are richly encrusted with sponges and ascidians. The algae present include *Caulocystis*, *Zonaria*, *Dictyota*, *Caulerpa*, *Ethelia* and *Champia*, and they support large populations of small gastropods, mainly species of *Clanculus*, *Micrastraea*, *Phasianotrochus* and rissoids. Other commonly occurring molluscs are *Scutus antipodes* Montfort, *Subninella undulata* (Solander), *Floraconus anemone* (Lamarck) and *Cominella eburnea* (Reeve). The tubiculous polychaete *Terebellides stroemi* Sars and the errant polychaetes *Eunice* and *Palola* are common under rocks. The urchin *Holopneustes inflatus* Lütken is found on weed, and the large urchin *Heliocidaris erythrogramma* Valenciennes is abundant under rock ledges. Also common are the sea-stars *Tosia australis* Gray, and *Patiriella brevispina* H. L. Clark, and the brittle star *Ophionereis schayeri* (Müller & Troschel). At Settlement Point, Corinella, a wave-cut platform flanked to the north by mud and rocks and to the south by tidal flats, is one of the few places in the east of the Bay where an extensive rock-platform type of flora and fauna is found. The fauna of this platform, while similar to that of the rock platforms in the south of the Bay, is charcterized by large numbers of the boring bivalve *Venerupis crenata* Lamarck embedded in the weathered basalt.

6. The Channel System

The North Arm and East Arm, together with their subsidiary feeder channels, the inlets and adjoining subtidal seagrass meadows form one of the major physiographic and ecological units of Westernport.

Seagrasses border the major and minor channels, cover the subtidal sandbanks and, in the northern and south-eastern regions of the Bay, form extensive meadows continuous with those of the tidal flats. The meadows have a rich plant community in which the seagrass *Heterozostera tasmanica* (G. Martens) Aschers is the dominant plant, although in areas sheltered from wave movement the green alga *Caulerpa cactoides* (Turner) C. Argardh may also be very abundant. The seagrass community supports a rich epiphytic red algal flora, and both algae and seagrass provide food, shelter and substratum for small species of hydroids, molluscs, crustacea, annelids, ascidians and sponges. The infauna of the seagrass meadows is similar to that of the tidal flats and is characterized by the bivalve molluscs *Homalina mariae, Katelysia rhytiphora* Lamy and *Anadara trapezia.*

The shallow channels and inlets have a plant community similar to that of the seagrass meadows and may also, at depths of 6-8 m, have a band of the angiosperm *Halophila ovalis* (R. Br.) Hook growing in soft mud. Near shore the biota of the minor channels is similar to that of the tidal flats, but near the confluence with the major channels there is a gradual intergradation with the deep channel fauna.

The main channels are from 10-30 m deep and have a moderate to very strong current flow. The substratum consists of fine to coarse clean sands, or sands mixed with organic detritus, shells and ironstone rubble. High water turbidity due to suspended sediment and organic matter reduces light penetration to the extent that plant-life is virtually absent from the channel floors.

The most conspicuous species of the channel-floor epifauna is a small apricot coloured seapen, *Sarcophyllum* sp. which may reach densities of 200 individuals/m^2. Old shell and rubble provide a substratum for the attachment of many other epifaunal species including the limpet-like gastropod *Sigapatella calyptraeformis* (Lamarck), the articulate brachiopod *Magellania australis* Quoy & Gaimard and the solitary ascidian *Pyura stolonifera* Heller. The leathery test of *P. stolonifera* offers a substratum for many epizoic species of small sponges, hydroids, and other ascidians. *Magellania australis,* a species uncommon in Bass Strait, is extremely abundant in Westernport and may attain densities of 250 individuals/m^2. Other members of the epifaunal community are the sea stars *Nectria ocellata* Perrier, *Patiriella brevispina* and *Tosia magnifica* (Müller & Troschel), and the echinoid *Goniocidaris tubaria* (Lamarck).

Conspicuous amongst the infauna are the molluses *Pronucula* spp., *Neotrigonia margaritacea* (Lamarck), *Notocallista diemenensis* (Hanley), *Bellucina crassillirata* (Tate) and *Venericardia bimaculata* (Deshayes). A small orange sponge, *Suberites sp.,* is commonly found attached to the shells of living *Neotrigonia.* Outcrops of lignitic bedrock on the channel floor may be bored by the bivalve *Pholas australasiae* Sowerby. Several species of carnivorous gastropods, including *Nassarius burchardi* (Phillipi), *Pterynotus triformis* (Reeve) and *Amorena undulata* (Lamarck), feed upon the bivalve population.

The two most abundant infaunal groups are the polychaetes and the crustaceans, although neither group is known in great detail.

7. Sublittoral Reefs

There are very few sublittoral reefs in Westernport Bay. Few are known on the southern part of the Bay or in East Arm, but some scattered outcrops of sandstone and lignite occur in North Arm. The largest of these outcrops, Crawfish Rock, a reef emergent at low tide, provides the only rocky shore habitat in the northern part of Westernport and has a littoral biota showing affinities with that of the intertidal platforms to the south.

Sublittorally, the horizontal distribution of the biota of Crawfish Rock is related to the strong tidal flow and current patterns, whilst vertical zonation of the algae is dependent upon light penetration. Where current flow is strongest there is a forest of the brown kelp *Ecklonia radiata* (C. Ag.) J. Agardh reaching to a depth of about 8 m. In more sheltered places there is a shallow-water *Sargassum-Scabaria-Caulerpa* community and a rich red algal flora which includes such delicate species as *Claudia elegans* Lamouroux, *Griffithsia teges* Harvey, *Myriogramme gunniana* (Harv.) Kylin and *Rhodymenia* sp.

At a depth of about 10-11 m where there is insufficient light to allow algal growth there is an abrupt transition to a rich and diverse invertebrate community. This is dominated in terms of biomass by the sponges *Ancorina corticata* Carter, *Geodia* sp., and *Ircinia* sp., whilst in number of species the smaller Aplysillidae are dominant. The ascidian fauna is rich in encrusting species, dominant amongst which are *Didemnum platulum* (Herdman), growing in places of moderate current flow, and the colonial species *Amphicarpa diptycha* (Hartmeyer) which grows where fine sediments are deposited. Solitary ascidians are poorly represented except for the orange and purple striped *Halocynthia hispida* (Herdman), a species widely distributed throughout the northern region of Westernport. Erect bushy colonies of the horny bryozoans *Amathia biseriata* Krauss and the

brilliant green *Bugula dentata* (Lamouroux) are very common where currents are strong, whilst the calcareous species *Celleporaria prolifera* (MacGillivray) and the lace-like *Triphyllozoon monolifera* (MacGillivray) prefer sheltered clefts in the rocks. The pycnogonid *Stylopallene longicauda* Stock and a small gastropod, *Microginella minutissima* (Tenison Woods) are known to spend their entire life cycles in association with *A. biseriata.* (D. A. Staples, pers. comm.; Murray 1970). The hydroid fauna includes the athecate species *Pennaria* sp. and *Eudendrium generalis* von Lendenfeld, often associated with calcareous bryozoa in sheltered places. Stolonic colonies of *Aglaophenia plumosa* Bale, *Plumularia setacoides* Bale, *Sertularia unguiculata* Busk and the scarlet *Halopteris buskii* (Bale) are common in places where currents are moderate, whilst the edges of large boulders exposed to maximum current flow are occupied by the large, erect species *Plumularia procumbens* Spencer and *Sertularella lata* (Bale). Other conspicuous members of the reef community are the sea stars *Nectria ocellata* and *Petricia vernicina* (Lamarck), and the very abundant echinoid *Heliocidaris erythrogramma* which feeds upon sea-grass drift.

DISCUSSION

Much has been written (e.g. Thorson 1957, Mills 1969) about the community concept in marine biology, the relationship between organism and environment, and the factors that must be borne in mind when choosing species with which to characterize a particular environment or type of habitat. In this paper Westernport Bay has been considered as being divisible into seven distinct types of habitat, and certain species, visually conspicuous because of their size, shape and colour have been described as characteristic of each habitat. However, the description of a species as characteristic of, or dominant in, a particular habitat does not necessarily imply that it is the most abundant species there. It is generally true that the most numerous animals are also the smallest and Stephenson et al. 1972, have noted that it may be necessary to choose as characterizing species those which are dominant by number or by weight, since it is not always possible to choose species which dominate by both characteristics. The most numerically abundant groups of the soft bottom infauna in Westernport Bay are the annelids and the crustaceans (in the two quantitative surveys conducted by the Fisheries and Wildlife Division, Victoria, these two groups provided at least 80% of all the individuals collected) but many species are precluded from a characterizing role because they are small, inconspicuous and not easily identifiable.

In dividing an area into several habitat types and characterizing each by a few dominant species there is a tendency to emphasize the discreteness of animal associations. It is true that some adjacent areas will show disjunct species distributions, and this is particularly so where hard, epifaunally colonized substratum adjoins an area of soft, infaunally colonized substratum, but in many cases one faunal zone will intergrade gradually with another without sharp discontinuities in distribution. Thus in Westernport the bivalves *Katelysia rhytiphora* and *Homalina mariae,* characteristic of the muddy tidal flats, and also found in the shallow muddy portions of the main channels, give way to *Neotrigonia* and other molluscs typical of the deeper channel areas only where the substratum contains less mud.

Approximately 2,000 species of invertebrates, including many new to science, are known from Westernport, and since it includes few meio- or micro-faunal species or even larger organisms such as sponges this figure must be regarded as a very conservative estimate. Even so, this shows Westernport Bay to be an area of great species richness and there are few, if any, other benthic surveys (e.g. Gilat 1964, Laakso 1965, Jones 1951, Gage 1972, Damodaran 1973, Hutchings & Retcher 1974, Stephenson et al. 1974) which give species lists indicative of the degree of faunal diversity that is found in Westernport.

In the northern region of the Bay the natural turbidity of the water reduces light penetration and this has led to a 'compression' of the photic zone so that plant growth is limited to relatively shallow water. For example, the brown kelp *Ecklonia radiata* grows down to a depth of only 8 m at Crawfish Rock compared with 30-35 m in neighbouring Bass Strait. Reduced light penetration, together with the secondary factors of shelter from deep wave movement and the presence of good current flow, has permitted the incursion into the channels and reefs of Westernport Bay some species more typical of a deeper water oceanic fauna. Amongst these are the hydroids *Plumularia procumbens* and *Halopteris buskii,* the bivalve *Neotrigonia margaritacea,* and the brachiopod *Magellania australis.*

Apart from its overall richness and diversity, the fauna of Westernport includes a number of species of particular interest.

Neotrigonia margaritacea is a living fossil form. More than one hundred species of fossil trigonias are known from Europe, North and South America and India, but living members of the family are found only in the waters around Australia where there are, supposedly, six species, one of

which, *Neotrigonia margaritacea*, is recorded from a few localities in southern New South Wales, Victoria and Tasmania. After the first discovery in 1802 of living members of the family, *Neotrigonia* was for a time considered so rare that even single, worn valves changed hands for large sums of money.

The brachiopod genus *Magellania* and a few related forms are found as fossils dating back at least as far as the early Tertiary only from the Australian region (Richardson, pers. comm.). Today, *Magellania australis* is confined to southern Australian waters, and so far as is known, occurs most abundantly in Westernport.

Living ark-shells *Anadara trapezia*, common in tidal flats from Queensland to New South Wales, are rare in Victoria but are abundant in deposits of Pleistocene age in Victoria and South Australia. One of the areas in Victoria in which *Anadara* is found is Westernport Bay, where extensive beds of *Anadara* occur in the mudflats. Within recent years *Anadara* has been transplanted from Westernport to South Australia in an attempt to re-establish it there (Plant 1957).

In summary it can be said that the fauna of Westernport Bay is remarkable for a number of reasons. One of the common species found there is a 'living fossil' with a very restricted distribution, and several others also have an extensive geological history; the natural turbidity of the water has reduced light penetration, particularly in the northern region of the Bay, leading to a compression of the vertical zonation shown by species and allowing the incursion of deeper water species, and the area shows a degree of species diversity for which there are few, if any, parallels recorded from any part of the world.

ACKNOWLEDGMENTS

We gratefully acknowledge the Marine Pollution Studies Group, Fisheries and Wildlife Division, Ministry for Conservation, Victoria, the Marine Study Group of Victoria and the Underwater Research Group of Victoria for permission to use unpublished data from their studies in Westernport Bay. We also wish to thank the following specialists for assistance with identification of material, and advice: Mr. K. Bell (Foraminifera), Dr. J. Richardson (Brachiopoda), Miss A. Watson (sponges) and Mr. D. Staples (Pycnogonida), of the National Museum of Victoria; Dr. P. Mather, Queensland Museum (Ascidiacea), Dr. H. B. S. Womersley, Adelaide University (algae), and Dr. Darwin Evans for reading and helpful criticism of the manuscript. In addition, the authors are grateful to the Westernport Bay Environmental Study for financial support, and to Professor M. A. Shapiro for his encouragement.

REFERENCES

Bird, E. C. F., 1971. Mangroves as land-builders. *Vict. Nat.* 88 (7): 189-197.

Blackburn, M., 1937. Notes on Australian Hydrozoa with descriptions of two new species. *Proc. R. Soc. Vict.* 50 (1): 171-181.

Carter, H. J., 1886. Sponges from South Australia. *Ann. Mag. Nat. Hist.*, (5) 18: 445-466.

Damodaran, R., 1973. Studies on the benthos of the mud banks of the Kerala coast. *Bull. Dept. Mar. Sc. Univ. Cochin.* vi, 1-126.

Gabriel, C. J., 1908. Excursion to Stony Point, Westernport. (List of Mollusca additional to previous). *Vict. Nat.* 26 (2): 19-20.

Gage, J., 1972. A preliminary survey of the benthic macrofauna and sediments in lochs Etive and Creran, sea lochs along the west coast of Scotland. *J. mar. Biol. Ass. U.K.* 52: 237-276.

Gatliff, J. H. & Gabriel, C. J., 1910. On Some New Species of Victorian Marine Mollusca. *Proc. R. Soc. Vict.* 23: 82-86, pll. 18-19.

——— & ———, 1910. Additions to the Catalogue of the Marine Shells of Victoria. *Ibid.* 23 (1): 87-98.

——— & ———, 1917. Additions to and Alterations in the Catalogue of the Marine Shells of Victoria. *Ibid.* 30: 21-25, pl. 3.

——— &———, 1931. Additions to and Alterations in the Catalogue of Victorian Marine Mollusca. *Ibid.* 43: 202-232.

Gilat, E., 1964. The macrobenthonic invertebrate communities on the Mediterranean continental shelf of Israel. *Bull. Inst. Oceongr. Monaco* 62, No. 1290, 1-46.

Hutchings, P. A. & Rechter, H. F., 1974. The fauna of Carcel Bay with comments on the ecology of mangrove and sea-grass communities. *Aust. Zool.* 18 (2): 99-128.

Jones, N. S., 1951. The bottom fauna off the south of the Isle of Man. *J. Anim. Ecol.* 20 (1): 132-144.

Laakso, M., 1965. The bottom fauna in the surroundings of Helsinki. *Ann. Zool. Fenn.* 2: 18-37.

Macgillivray, P. H., 1859. Notes on the Cheilostomatous Polyzoa of Victoria and other parts of Australia. *Trans. phil. Inst. Vict.* 4: 159-168, pls. 2, 3.

———, 1868. Descriptions of some new Genera and Species of Australian Polyzoa; to which is added a List of Species found in Victoria. *Trans. & Proc. R. Soc. Vict.* 9: 126-148.

Marine Study Group of Victoria (B. J. Smith, ed.), 1971. Littoral Survey of Westernport Bay. Interim Report. (Unpubl.).

Mills, E. L., 1969. The community concept in marine zoology, with comments on continua and instability in some marine communities: a review. *J. Fish. Res. Bd. Canada* 26: 1415-1428.

Murray, Florence V., 1970. The reproduction and life history of *Microgenella minutissima* (Tenison-Woods, 1876) (Gastropoda: Marginellidae), *Mem. natn. Mus. Vict.* 31: 31-35.

Parr, W. J., 1932. Victorian and South Australian Shallow-Water Foraminifera, Part 1. *Proc. R. Soc. Vict.* 44: 1-14, pl. 1.

———, *Ibid.* 44: 218-234, pl. 21.

PLANT, R. J., 1957. Existing beds of the bivalve *Anadara trapezia* Deshayes 1840 in Westernport, Victoria. *J. Malacol. Soc. Aust.* 1: 34-35.

PRITCHARD, G. B. & J. H. GATLIFF, 1898. Catalogue of the Marine Shells of Victoria, Part I. *Proc. R. Soc. Vict.* 10: 236-284.

———— & ————, 1900. Catalogue of the Marine Shells of Victoria, Part III. *Ibid.* 12: 170-205.

———— & ————. On Some New Species of Victorian Mollusca, No. 4. *Ibid.* 13: 131-139, pl. 20, 21.

———— & ————. Catalogue of the Marine Shells of Victoria, Part IV. *Ibid.* 13: 140-156.

STEPHENSON, W., WILLIAMS, W. T. & COOK, S. D., 1972. Computer analyses of Petersen's original data on bottom communities. *Ecol. Monographs.* 42 (4): 387-415.

————, ———— & ————, 1974. The benthic fauna of soft bottoms, southern Moreton Bay. *Mem. Qd. Mus.* 17 (1): 73-123.

UNDERWATER RESEARCH GROUP OF VICTORIA. (J. E. Watson, ed.) 1971. Preliminary account of the benthic flora and fauna of N.S. Westernport. (Unpubl.).

Westernport Bay